

Appl. No. 10/729,458
Reply to Office Action of September, 2005

AMENDMENTS TO THE CLAIMS

This listing and version of the claims replace all prior listing and versions of the claims.

Listing of Claims:

1. (currently amended) A method of forming multiple gate insulator layers on a semiconductor substrate, comprising the steps of:

forming a first insulator layer on said semiconductor substrate;

forming a photoresist shape on a first section of said first insulator layer;

removing a second section of said first insulator layer exposing a bare first section of said semiconductor substrate;

performing a first photoresist removal procedure resulting in partial removal of said photoresist shape and forming a second insulator layer on said bare first section of said semiconductor substrate;

performing a second photoresist removal procedure completely removing said photoresist shape; and

performing a procedure to convert said first insulator layer located on a second section of said semiconductor substrate, to a first gate insulator layer, and to convert said second insulator layer to a second gate insulator layer, wherein the thickness of said first gate insulator is different than the thickness of said second gate insulator layer; ~~and forming a first conductive gate structure on said first gate insulator layer and forming a second conductive gate structure on said second gate insulator layer.~~

2. (original) The method of claim 1, wherein said first insulator layer is a silicon dioxide layer, at a thickness between about 10 to 200 Angstroms.

3. (original) The method of claim 1, wherein removal of said second section of said first insulator layer is accomplished via use of a buffered hydrofluoric (BHF) acid solution.

4. (original) The method of claim 1, wherein said first photoresist removal procedure is performed using ozone water.

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5. (original) The method of claim 1, wherein said second insulator layer formed on said second section of said semiconductor substrate, is a silicon oxide layer at a thickness between about 8 to 10 Angstroms.

6. (original) The method of claim 1, wherein said second photoresist removal procedure is performed using a sulfuric acid - hydrogen peroxide mixture (SPM).

7. (currently amended) The method of claim 1, wherein said second photoresist removal procedure is performed at a temperature between about 110 to 150°C.

8. (original) The method of claim 1, wherein said procedure used to convert said first insulator layer and said second insulator layer to gate insulator layers is an oxidation procedure, performed in an oxygen - steam ambient.

9. (original) The method of claim 1, wherein said procedure used to convert said first insulator layer and said second insulator layer to gate insulator layers is an oxidation procedure, performed at a temperature between about 800 to 1050° C.

10. (original) The method of claim 1, wherein said first gate insulator layer is a silicon dioxide layer, at a thickness between about 15 to 200 Angstroms.

11. (original) The method of claim 1, wherein said second gate insulator layer is a silicon dioxide layer, at a thickness between about 10 to 100 Angstroms.

12. (currently amended) The method of claim 1 further comprising forming a first conductive gate structure on said first gate insulator layer and forming a second conductive gate structure on said second gate insulator layer, wherein said first conductive gate structure and said second conductive gate structure are comprised of doped polysilicon.

13. (currently amended) The method of claim 1 further comprising forming a first conductive gate structure on said first gate insulator layer and forming a second conductive gate structure on said second gate insulator layer, wherein said first conductive gate structure and said second conductive gate structure are comprised of metal silicide.

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14. (currently amended) A method of forming a semiconductor device on a semiconductor substrate featuring multiple gate insulator thicknesses, comprising the steps of:
- forming a first silicon oxide layer ~~on entire surface of over~~ said semiconductor substrate;
 - forming a photoresist shape on a first section of said first silicon oxide layer, in a region overlying a first section of said semiconductor substrate;
 - removing a second section of said first silicon oxide layer exposing a bare second section of said semiconductor substrate;
 - performing an ozone containing mixture procedure to partially remove said photoresist shape and to form a second silicon oxide layer on said bare second section of said semiconductor substrate;
 - performing a sulfuric acid - hydrogen peroxide mixture (SPM) procedure, to completely remove said photoresist shape; and
 - performing an oxidation procedure to convert said first silicon oxide layer to a first gate insulator layer on said first section of said semiconductor substrate, and to convert said second silicon oxide layer to a second gate insulator layer, wherein the thickness of said first gate insulator is greater than the thickness of said second gate insulator layer; ~~and~~
 - forming a first conductive gate structure on said first gate insulator layer; and
 - forming a second conductive gate structure on said second gate insulator layer.
15. (original) The method of claim 14, wherein said first silicon oxide layer is a silicon dioxide layer, at a thickness between about 10 to 200 Angstroms.
16. (original) The method of claim 14, wherein removal of said second section of said first silicon oxide layer is accomplished via use of a buffered hydrofluoric (BHF) acid solution.
17. (original) The method of claim 14, wherein removal of said second section of said first silicon oxide layer is accomplished via dry etching procedures using CHF₃ as a selective etchant for said first silicon oxide layer.
18. (currently amended) The method of claim 14, wherein ozone water procedure is performed at a temperature between about 20 to 500 °C.
19. (original) The method of claim 14, wherein the thickness of said second silicon oxide layer formed on said second section of said semiconductor substrate, is between about 8 to 10 Angstroms.

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20. (original) The method of claim 14, wherein said sulfuric acid - hydrogen peroxide mixture (SPM) procedure is performed at a temperature between about 110 to 150°C.

21. (currently amended) The method of claim 14, wherein said oxidation procedure is performed at a temperature between about 800 to 1050 °C.

22. (original) The method of claim 14, wherein said first gate insulator layer is a silicon dioxide layer, at a thickness between about 15 to 200 Angstroms.

23. (original) The method of claim 14, wherein said second gate insulator layer is a silicon dioxide layer, at a thickness between about 10 to 100 Angstroms.

24. (original) The method of claim 14, wherein said first conductive gate structure and said second conductive gate structure are comprised of doped polysilicon.

25. (original) The method of claim 14, wherein said first conductive gate structure and said second conductive gate structure are comprised of metal silicide.

26. (new) A method of forming multiple insulator layers, comprising following steps of:

(a) forming a first insulator layer over a substrate;

(b) removing a portion of the first insulator layer with a photoresist pattern to expose a top surface of a substrate region at the removed portion of the first insulator layer; and

(c) removing the photoresist pattern while forming a second insulator layer over the exposed to top surface of substrate region, wherein a remaining portion of the first insulator layer is thicker than the second insulator layer.

27. (new) The method of claim 26, wherein step (c) comprises:

exposing the top surface of the substrate region and the photoresist pattern to an ozone containing mixture to partially remove the photoresist pattern while forming the second insulator; and

exposing the second insulator layer and the photoresist pattern to a sulfuric acid-hydrogen peroxide mixture (SPM) to remove a remaining portion of the photoresist pattern.

28. (new) The method of claim 27, wherein the ozone containing mixture has a temperature between about 20 to 50 °C, and the SPM has a temperature between about 110 to 150 °C.

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29. (new) The method of claim 28, wherein step (c) forms the second insulator layer to a thickness between about 8 to 10 Angstroms.

30. (new) The method of claim 29 further comprising forming a first conductive gate structure and a second conductive gate structure over the first and second gate insulator layers, respectively.